LI-BIRD

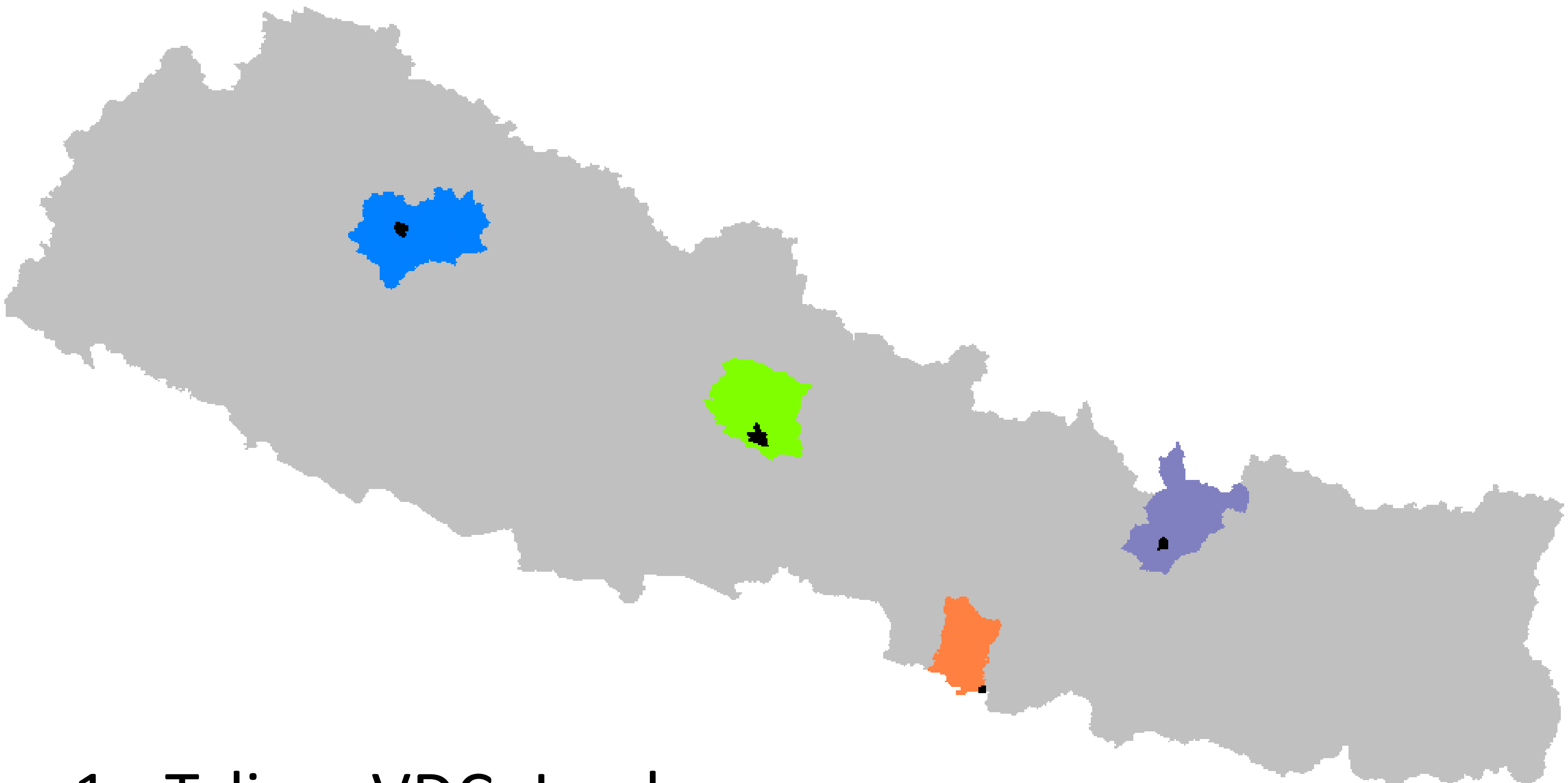
CELEBRATING 20 YEARS of Research & Development in Nepal

A Case for Research and Development in Neglected and Underutilized Species

Sajal Sthapit

Programme Coordinator

Project Sites



1. Talium VDC, Jumla
2. Pokhara and surrounding villages, Kaski
3. Kachorwa VDC, Bara
4. Namdu VDC, Dolakha

Implementing Partners

- NARS
  - Hill Crops Research Programme (Dolakha)
  - National Genebank
- CSOs:
  - Network for Agrobio. Conservation (NABIC)
  - Bioresources Conservation Movement, Begnas, Kaski
  - Agriculture Development and Conservation Society (ADCS), Bara
  - BCDC, Namdu, Dolakha and Talium Jumla
- Local stakeholders:
  - Lekhnath Municipality, DADOs, business actors, schools Anamolbiu Pvt. Ltd.
- Bioversity Intl, MSSRF, Proinpa, IFAD

Project Objectives, Target & Progress

Objective 1

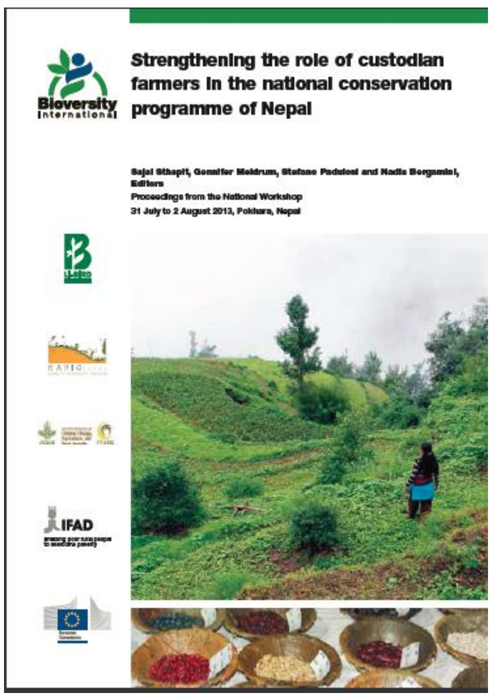
Test new methods & tools for on farm conservation

Target

- PACS tested
- Custodian farmers' network mobilized
- Use enhancement

Progress

- PACS Piloted through CBM fund,
- Included mechanism in institutional policy of CBM project (20% of interest for local seed purchase)
- Custodian farmer is being defined, Organized National Level custodian Farmers Workshop,
- Participatory Seed Exchange
- Research on Amaranth



Project Objectives, Target & Progress

Objective 2

Monitoring of diversity on-farm

Target

- CBR method refined
- Five Cell Analysis tested
- CSBs strengthened
- Red listing of Agrobiodiversity tested

Progress

- Diversity fair and CBR on NUS in Bara and Dolakha
- Infrastructure support for CSB in Jumla and other CSBs established through other projects
- CSB network established and work in progress to link with National Genebank
- CBR format revision and in the process of testing and adoption in DADOs of WDR and CCCR project (donor)
- Five Cell Analysis is tested in Namdu and Begnas, and varieties are rehabilitated (e.g White Rayo in Namdu)

Project Objectives, Target & Progress

Objective 3

Promote complementary conservation agenda in national programmes

Target

- Create policy and government support for on-farm conservation
- *Ex situ* and *in situ* linkages

Progress

- CSB Workshop organized
- Genebank + CSB linkage initiated
- Joint Agreement for Agrobiodiversity Conservation Area in Begnas signed and implemented

Objective 4

Findings to guide research on climate change and its impact to local production systems

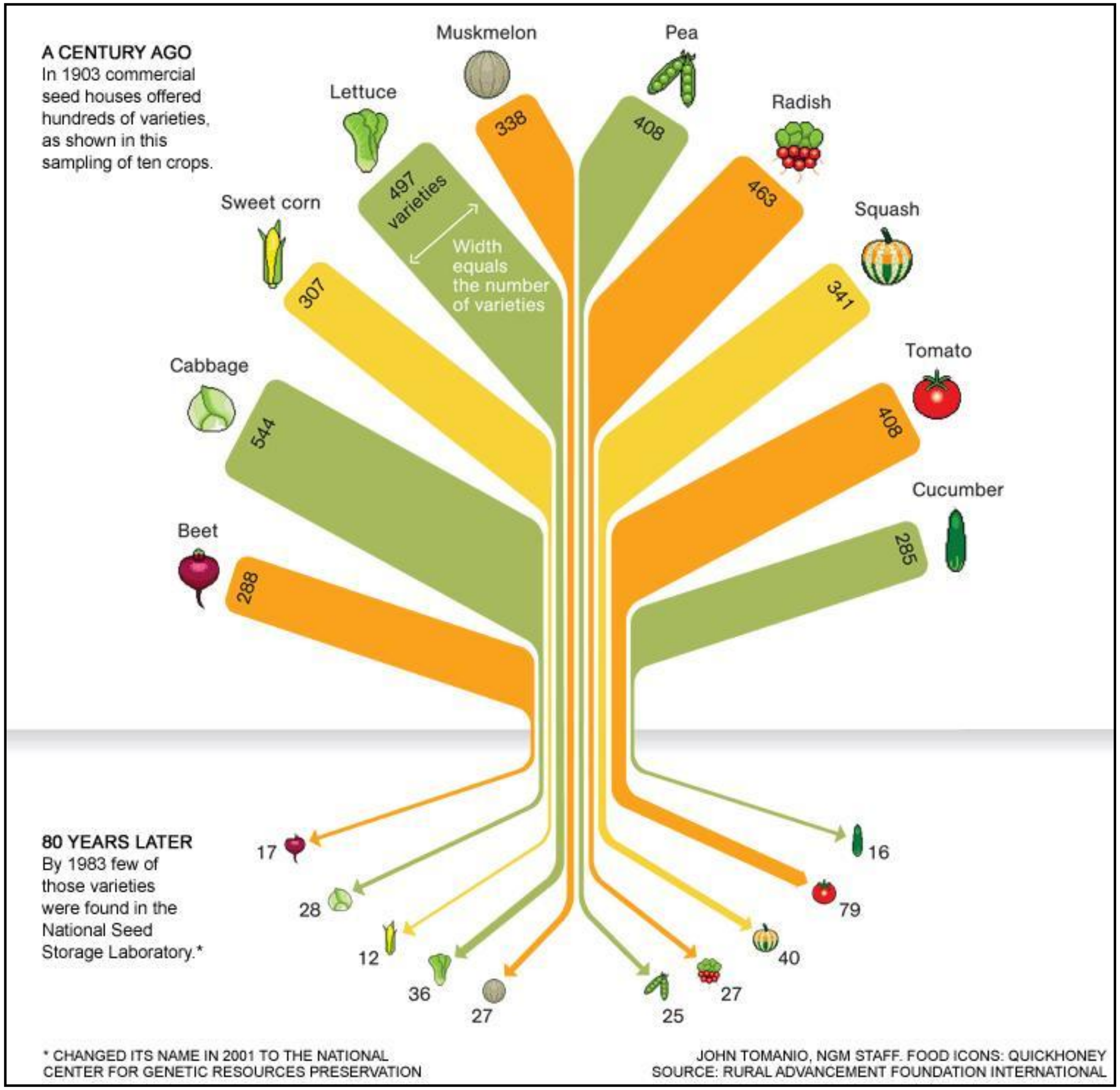
Target

- Enhanced understanding of distribution of NUS diversity and traditional knowledge

Progress

- Paper by Gennifer (Climate Change, is in progress)
- Support on some adaptation work in Namdu (e.g Irrigation Pond)

Loss of Agrobiodiversity



75% of world's agrobiodiversity is already lost

75% of land is planted with MVs of rice in Asia

India's food: 30,000 landraces to mainly 50 modern varieties of rice

China: 10,000 wheat cultivar in 1894, 1,000 in 1970s

USA: lost 90% of cultivars of cabbage, pea, and maize

Not All Diversity is Not the Same

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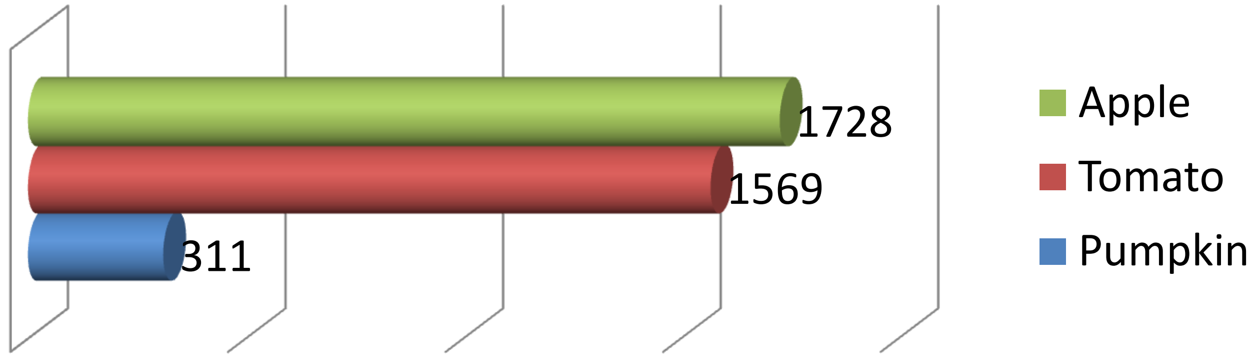
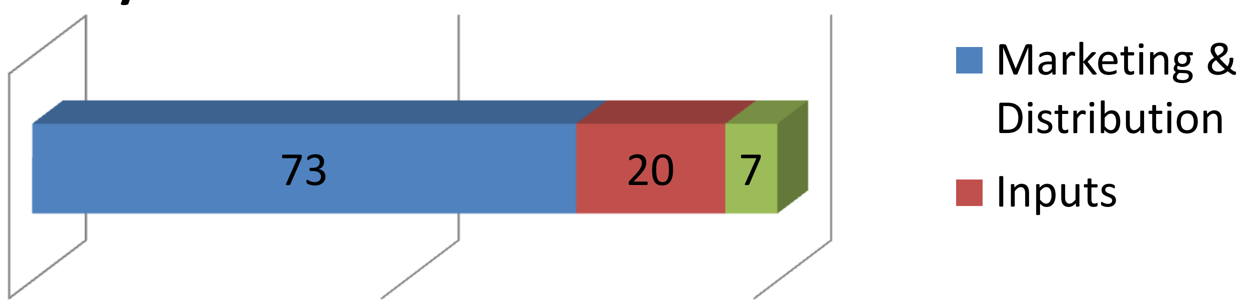
- **250,000 to 300,000** known edible plant species. Only **150 to 200** are used
- 20 species →**90%** food and 3 species (Rice, maize and wheat) ~**60%** of calories and proteins
- 75% of the world's food is generated from only 12 plants and 5 animal species.

What is the Consequence?

- Food Miles:

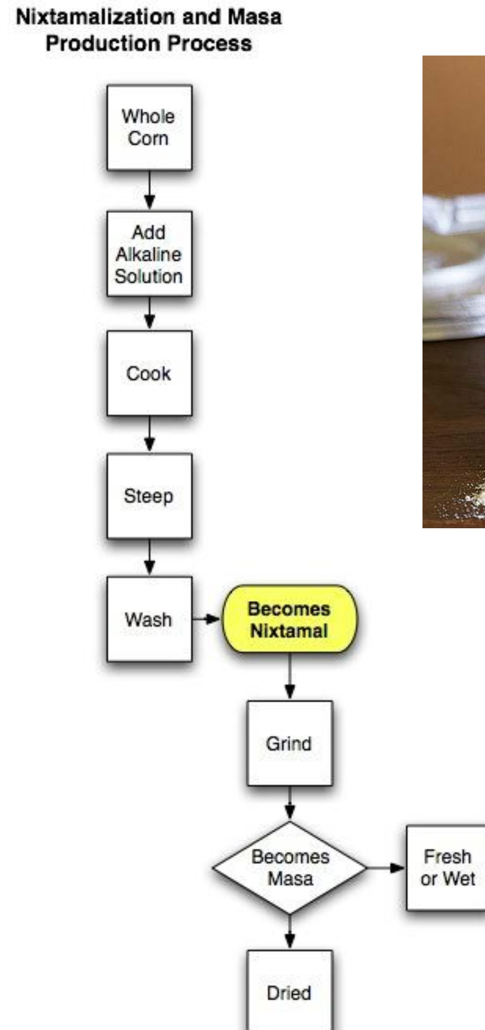


- Income Disparity:



- Increase in obesity, diabetes, healthcare costs, etc.

Power of Research



Images from wikimedia commons

Valuing What You Have: Kimchi Museum

Images from wikimedia commons

Native Seeds/SEARCH

Chile Seed Collection

Complete Garden Collection

Container Garden Collection

Heirloom Seed Collection

Herb Garden Collection

Heritage Seed Collection

Low Desert Wildflower Garden Collection

Monsoon Garden Collection

New Approaches are Needed

Available online at www.sciencedirect.com
ScienceDirect
Field Crops Research 102 (2007) 172–177
Field Crops Research
www.elsevier.com/locate/fcr

Evidence of varietal adaptation to organic farming systems

Kevin M. Murphy [a], Kimberly G. Campbell [b], Steven R. Lyon [a], Stephen S. Jones [a,*]

[a] Department of Crop and Soil Sciences, Washington State University, 201 Johnson Hall, Pullman, WA 99164-6420, United States
[b] 379 Johnson Hall, USDA-ARS, Pullman, WA 99164-6420, United States

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Abstract

Consumer demand regarding the impacts of conventional agriculture on the environment and human health have spurred the growth of organic farming systems; however, organic agriculture is often criticized as low-yielding and unable to produce enough food to supply the world's population. Using wheat as a model crop species, we show that poorly adapted cultivars are partially responsible for the lower yields often found in organic farming systems when compared with conventional farming systems. Our results demonstrate that the highest yielding soft white winter wheat genotypes in conventional systems are not the highest yielding genotypes in organic systems. An analysis of variance for yield among 35 genotypes between paired organic and conventional systems showed highly significant ($P < 0.001$) genotype × system interactions in four of five locations. Genotypic ranking analysis using Spearman's rank correlation coefficient (R_S) showed no correlation between genotypic rankings for yield in four of five locations; however, the ranks were correlated for test weight at all five locations. This indicates that increasing yield in organic systems through breeding will require direct selection within organic systems rather than indirect selection in conventional systems. Direct selection in organic systems produced yields 15%, 7%, 31% and 5% higher than the yields resulting from indirect selection for locations 1–4, respectively. With crop cultivars bred in and adapted to the unique conditions inherent in organic systems, organic agriculture will be better able to realize its full potential as a high-yielding alternative to conventional agriculture.
Published by Elsevier B.V.

Keywords: Plant breeding; Genotype × system interaction; Organic agriculture; Wheat; Indirect selection

1. Introduction

The major challenge of organic farming systems is to maintain high yields and excellent quality utilizing farming practices that have acceptable environmental impacts (Tilman et al., 2002). Organic farming has been shown to improve many different environmental and human components of the agroecosystem (Bulluck et al., 2002; Kramer et al., 2006; Reganold et al., 2001).

Despite the potential environmental benefits of organic farming, the question must be addressed of whether organic agricultural systems are capable of producing enough food to feed the world's population today and in 2050, when global population is projected to reach 9 billion and global grain demand is expected to double (Tilman et al., 2002). Organic agriculture has been criticized as low-yielding and less efficient than conventional agriculture in its use of land and resources (Trewavas, 2004). The term 'conventional' is defined in this paper as high-input, chemical intensive agricultural systems.

Several yield trial comparisons between organic and conventional farming systems have shown significantly lower yields for organic systems (Ryan et al., 2004; Stanhill, 1990). Padel and Lampkin (1994) reported that crop yield comparisons depend on the crop in question, with 60% lower yields in California rice (*Oryza sativa* L.) and 50% higher yields in Midwest oats (*Avena* spp.) for organic agriculture. Other studies of organic and/or alternative (low input/sustainable) systems report yields comparable to conventional systems in maize (*Zea mays*) (Pimentel et al., 2005), apples (*Malus* spp.) (Reganold et al., 2001), tomatoes (*Lycopersicon lycopersicum*) (Clark et al., 1999) and soybeans (*Glycine max* (L.) Merr.) (Pimentel et al., 2005; Smolik and Dobbs, 1991; Stanhill, 1990).

These studies describe current conditions in organic and conventional agriculture in a variety of crop species; however, they rely primarily on modern cultivars that have been selected by plant breeders under conventional systems that may not accurately represent the conditions present in organic farming

* Corresponding author. Tel.: +1 509 335 4877; fax: +1 509 335 8674.
E-mail addresses: joness@wsu.edu, jones1@indiana.edu (S.S. Jones).

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Breeding for organic and low-input farming systems: An evolutionary–participatory breeding method for inbred cereal grains

Kevin Murphy, Doug Lammer, Steve Lyon, Brady Carter, and Stephen S. Jones*

Department of Crop and Soil Sciences, Washington State University, Pullman, WA 99164-6420, USA.
*Corresponding author: joness@wsu.edu

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Abstract

Organic and low-input farmers often plant seed varieties that have been selected under conventional practices, traditionally including high inputs of artificial fertilizers, crop protection chemicals and/or water. In addition, these crops are often selected in environments that may or may not represent the local environment of the farmer. An evolutionary participatory breeding (EPB) method emphasizes the utilization of natural selection in combination with site-specific farmer selection in early segregating generations of a heterogeneous crop population. EPB is a combination of two specific breeding methods, evolutionary breeding and participatory plant breeding. Evolutionary breeding has been shown to increase yield, disease resistance, genetic diversity and adaptability of a crop population over time. It is based on a mass selection technique used by farmers for over 10,000 years of crop improvement. Participatory plant breeding programs originated in developing countries to meet the needs of low-input, small-scale farmers in marginal environments who were often overlooked by conventional crop breeders. The EPB method is an efficient breeding system uniquely suited to improving crop varieties for the low-input and organic farmer. The EPB method utilizes the skills and knowledge of both breeders and farmers to develop heterogeneous landrace populations, and is an effective breeding method for both traditional and modern farmers throughout the world.

Key words: plant breeding, bulk breeding, sustainable agriculture, landrace, yield, disease, quality, ecological agriculture

Introduction

Genetically uniform varieties developed by standard pedigree breeding methods dominate commercial production in many self-pollinated crops due, in large part, to their high yields and wide geographic adaptability[1,2]. These varieties perform optimally when they are grown in favorable environments and under high-input agronomic systems. However, they typically do not perform well in marginal environments or without the external inputs with which they were selected[2,3]. Serving the needs of producers in these marginal environments, whose farm conditions and practices minimize chemical inputs, has become a critical challenge to public plant breeders.

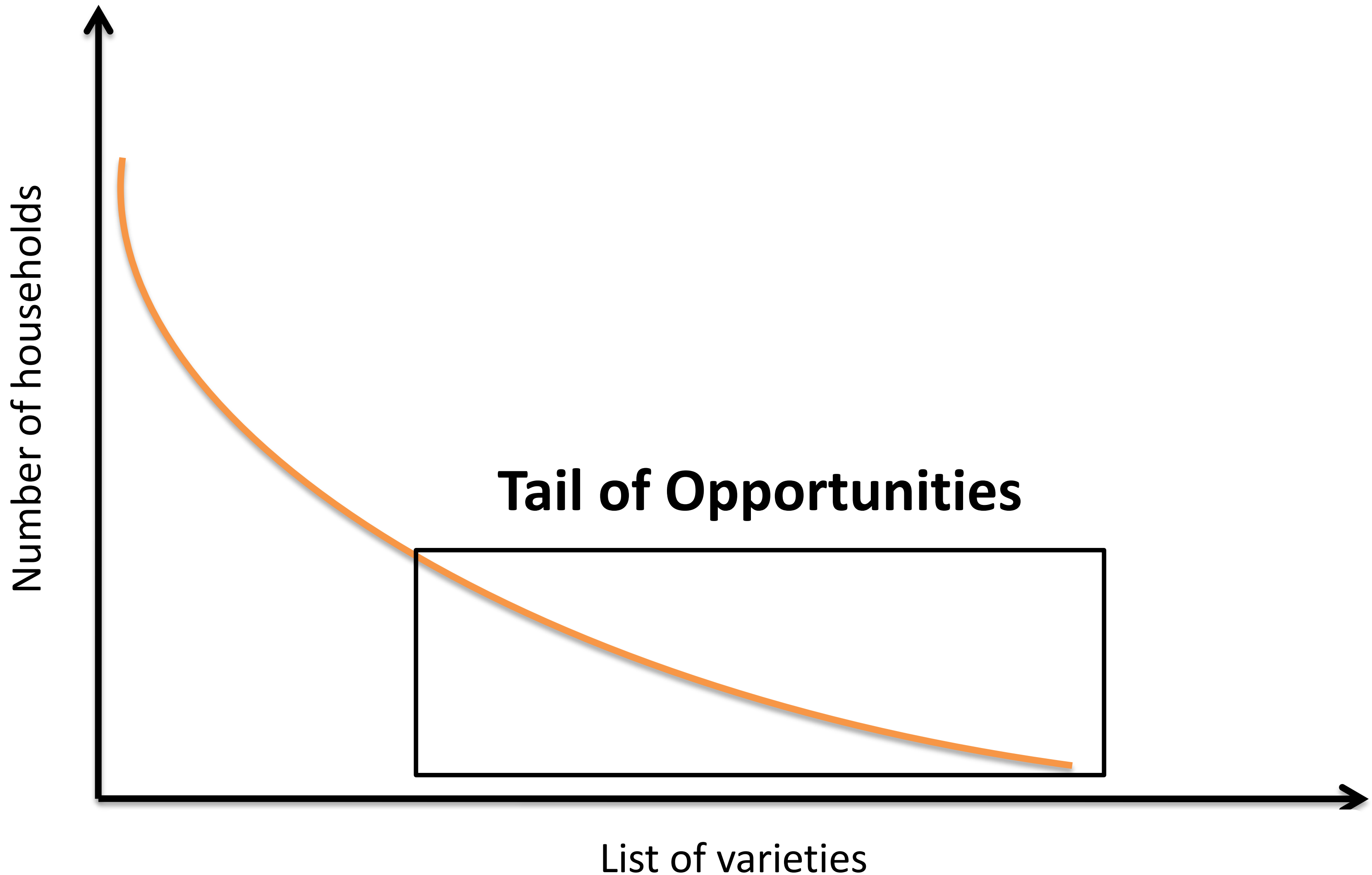
The global growth in the sales of certified organic products has increased by an average of 20–25% per year since 1990[4]. Organic farmers rely on varieties bred and selected under conventional methods that often include the use of synthetic pesticides and fertilizers, options not available under organic certification standards. Worldwide, an estimated 1.4 billion people are dependent on traditional agricultural systems characterized by marginal agricultural environments and limited use of external inputs[5]. These two groups represent a diverse array of farming systems in both developed and developing countries throughout the world. Future increases in agricultural stability and productivity may depend on increasing yields in these low-input and organic farming systems.

In organic and low-input agriculture, where synthetic pesticides and fertilizers are not applied due to regulatory or socio-economic reasons, genetic variation is the primary mechanism for buffering environmental fluctuations and maintaining important traits such as yield stability, resistance to pathogens and adaptation to low soil fertility. For this reason, many small-scale, low-input farmers have not wholly embraced homogeneous modern cultivars, choosing instead to rely on a diverse collection of local varieties and landraces[6]. Landraces are heterogeneous crop populations developed over time through both farmer selection and evolutionary processes. Additionally, a farmer's particular

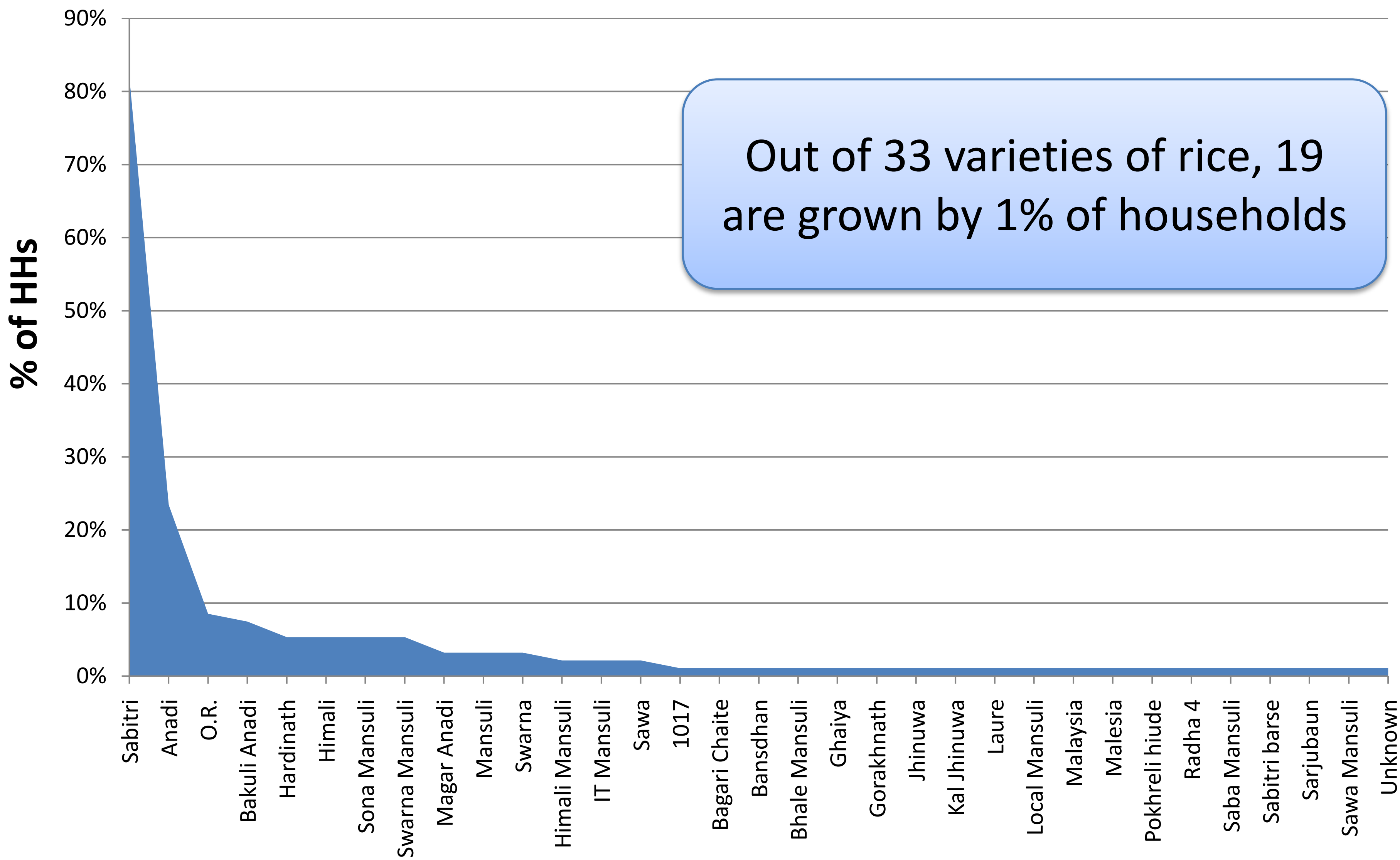
Increasing Demand for Alternative Grains

Untapped Potential of Diversity

Distribution of Varieties On Farm



Case from Agyouli, Nawalparasi



Interest Among Farmers

Participatory Seed Exchange

http://www.libird.org/app/publication/view.aspx?record_id=109

असल अभ्यास

स्थानीय बीउमा सुलभ पहुँचका लागि सहभागितामूलक बीउ आदानप्रदान

पीताम्बर श्रेष्ठ, सजल स्थापित र इन्द्रप्रसाद पौडेल

तस्विरः पीताम्बर श्रेष्ठ/ली–बर्ड

परिचय

नेपाललगायत विश्वका विभिन्न देशका कृषकहरूले आफ्नो खेतबारी तथा घरबगैंचाका लागि आवश्यक बीउ आफ्नो घरमा जोगाएर वा भण्डारण गरेर राख्ने चलन सदियौंदेखि चल्दै आएको छ। यसका अतिरिक्त कृषकहरूका बीच एकापसमा बीउ तथा त्यसबारेको जानकारी आदानप्रदान वा साटासाट गर्ने कार्य पनि परापूर्वकालदेखि नै चल्दै आएको छ। जस अनुसार आफूसँग भएका राम्रा जातका बीउबिरूवा आफ्ना छिमेकी, आफन्त वा साथीभाइहरूलाई दिने र उनीहरूबाट पनि आफूलाई मनपर्ने वा आफ्नो खेतबारीमा हुन सक्ने बीउबिरूवा ल्याएर लगाउने गरिन्छ। नेपालका कृषकहरूका लागि आवश्यक पर्ने बीउको ९० प्रतिशतभन्दा बढी अंश यसै प्रक्रियाबाट पूरा हुन्छ। यसका थुप्रै सकारात्मक पक्षहरू छन्। जस्तैः कृषकहरूले बजारमा महँगो मूल्य तिरेर बीउ खरिद गर्नु नपर्ने; आफूलाई आवश्यक पर्ने बीउ खोज्न टाढाटाढा जान नपर्ने; आफ्नो खेतबारी र घरबगैंचामा बालीनाली वा विविधताको सङ्ख्यामा सजिलै वृद्धि हुने; त्यसै अनुसार विभिन्न थरीका बालीहरूको उत्पादन हुने; आफूले चिनेजानेका स्रोतबाट बीउ ल्याइने भएकाले फल्छ वा फल्दैन भन्ने शङ्का नमानीकन निर्धक्कसँग खेती गर्न सकिने; अन्ततः स्थानीय जातका बालीहरूका हकमा त्यसको खेती गर्ने कृषक तथा बालीले ढाक्ने क्षेत्रफल वृद्धि भई ती जातहरूको संरक्षण र निरन्तर विकास हुने।

यसरी सबै पक्षबाट फाइदै-फाइदा हुने र नेपालजस्तो बहुसङ्ख्यक साना कृषकहरू भएको र भौगोलिक विकटता तथा विकासका पूर्वाधारहरूको कमी भएको देशमा कृषकहरूका बीचमा एकापसमा हुने बीउको साटासाटको चलनलाई अझ बढावा दिनु आवश्यक छ। सहभागितामूलक बीउ आदानप्रदान यस्तै एक पद्धति हो जसले कृषकहरूका बीचमा व्यक्तिगत रूपमा हुने बीउ तथा जानकारीको आदानप्रदान प्रक्रियालाई सामूहिक र व्यवस्थित रूपमा अघि बढाउन मद्दत पुऱ्याउँदछ। अतः कृषक समूहका बीचमा निश्चित मिति र स्थानमा तय गरिएको बीउ आदानप्रदान कार्यक्रममा भाग लिई एकापसमा बीउ तथा त्यसबारेको जानकारी साटासाट गरिने पद्धतिलाई सहभागितामूलक बीउ आदानप्रदान भनिन्छ।

उद्देश्य

सहभागितामूलक बीउ आदानप्रदान गर्नाका निम्नलिखित उद्देश्यहरू रहेका छन्:

- कृषकहरूका बीचमा व्यक्तिगत रूपमा हुँदैआएको बीउ आदानप्रदान प्रक्रियालाई थप व्यवस्थित र सुदृढ गर्ने;
- कृषकहरूलाई बढीभन्दा बढी बीउ छनोटको अवसर उपलब्ध गराई सकेसम्म धेरै जातका बालीहरू खेतबारी तथा घरबगैंचामा लगाउन उत्प्रेरित गर्ने;
- स्थानीय जातका बीउहरूका साथै ती बीउहरूसँग सम्बन्धित जानकारी तथा परम्परागत ज्ञान एक आपसमा साटासाट गरी विस्तार गर्ने;

Interest Among Youth & Consumers

LI-BIRD

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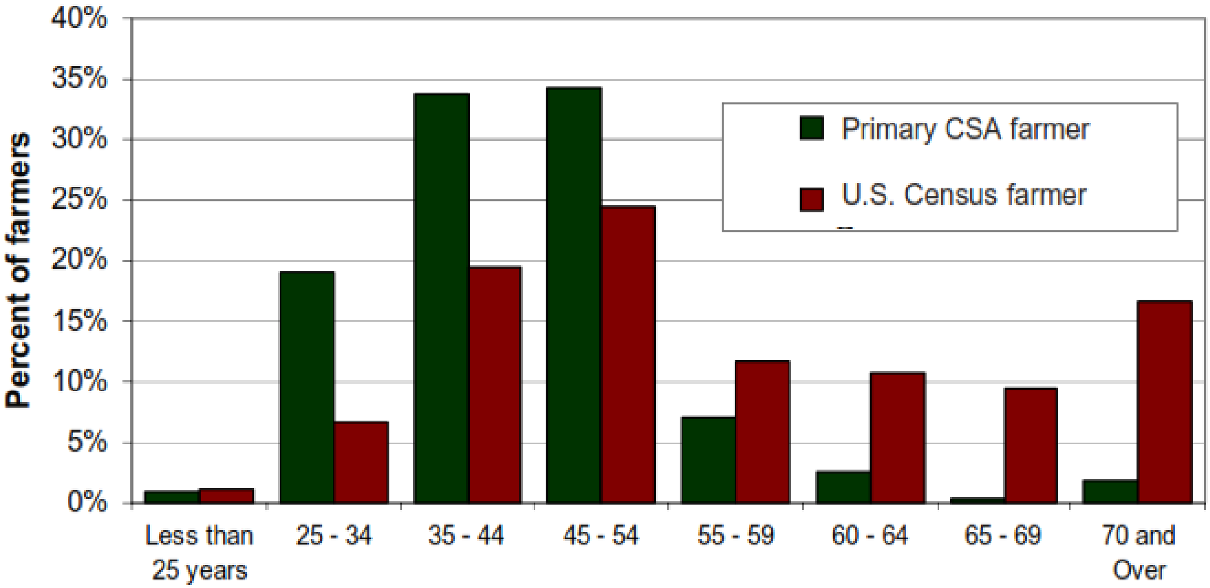
share

Date: 11/27/2014

By Pitambar Shrestha, Programme Officer of LI-BIRD based in Nawalparasi.

Community Supported Agriculture

Age distributions for CSA farmers and 1997 U.S. Census of Agriculture farm operators



Creating Demand via Consumer Awareness

- Environmental Working Group's annual list of fresh produce and vegetables for organic consumers
- Dirty Dozen
- Clean Fifteen
- www.ewg.org

Holistic Approach is Needed

Total No. of farmers	Total No. of consumers
No. of farmers potentially **interested** in growing unique varieties	No. of consumers potentially **interested** in unique varieties & organic produce
No. of farmers **growing** unique varieties	No. of consumers **buying** unique varieties & organic produce

Create new generation of leaders

We need insights from new disciplines

What can your role be?